STOPPING WATER POLLUTION AT ITS SOURCE

MISA
Municipal/Industrial Strategy for Abatement

ECONOMIC IMPLICATIONS OF THE MISA MONITORING REGULATIONS ON ONTARIO'S IRON AND STEEL SECTOR FINAL REPORT

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Ontario
Ministry of the Environment
Jim Bradley
Minister

Economic implications of the MISA monitoring regulations on Ontario's iron and steel sector : final report.

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MUNICIPAL-INDUSTRIAL STRATEGY FOR ABATEMENT (MISA)

ECONOMIC IMPLICATIONS OF THE MISA MONITORING REGULATIONS ON ONTARIO'S IRON AND STEEL SECTOR

FINAL REPORT

Socio-Economic Section
Policy and Planning
Corporate Resources Division

May 1989

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ABSTRACT

Estimates of the incremental capital and operating costs to Ontario's seven iron and steel plants who are direct dischargers subject to MISA monitoring requirements are derived and summarized. Cost estimates include costs provided by the plants through an industry representative.

Capital and operating costs were estimated for each of the five key monitoring activities:

- sampling requirements
- analytical requirements (characterization and routine analyses)
- toxicity testing
- flow measurement
- reporting

Incremental capital costs for the sector are estimated to be $5.1 million, and could range from $3.0 to $7.1 million using a factor of +/- 40%.

- Flow measurement devices account for 65% of total capital costs, sampling equipment accounts for 35% and reporting requirements account for less than 1%.

Operating costs over the 12 month period are estimated at $3.3 million, using average test prices for analytical testing.

- Analytical testing accounts for 63% of the costs, while sampling amounts to 24%, reporting and administration 7% and flow measurement accounts for the remaining 6%.

The total estimated incremental cost of the MISA monitoring requirements for the iron and steel sector ranges from $6.3 to $10.4 million.

Two companies which own four integrated steel mills are expected to bear 92% of the total estimated costs to the sector. The analytical requirements are more extensive and rigorous for integrated mills than for the mini-mills.

If all plants were required to monitor all effluent streams for a consistent set of parameters at the same frequency, routine analyses for this sector would total $4.6 million. This compares with $1.8 million under the proposed requirements. This difference of $2.8 million represents

a cost saving, and is a measure of the cost- effectiveness of the process-specific nature of the Iron and Steel Regulation.

The financial impacts of the estimated monitoring costs on the iron and steel sector were analyzed using historical financial data for the period 1981-1987. The analyses indicates that for the iron and steel companies under review, the financial impacts of monitoring do not appear to impose a significant burden for the firms.

- Average annual after-tax earnings for the sector would have been reduced by approximately 1.3% due to monitoring costs. For the year when losses were incurred, monitoring costs would have increased after-tax losses by approximately 8%. The effects are varied among the individual plants.

- The estimated capital costs of monitoring represents .7% of average annual capital expenditures during 1981-1987. For the year when capital expenditures were at their lowest, monitoring capital costs would have represented only 1.9% of capital expenditures.

Potential benefits to the firms of the monitoring regulation include gains in productivity by improving processes, reduction in water usage in manufacturing processes and in raw material losses in wastewater, and goodwill gained by demonstrating to the public that they are responding to environmental problems.

The monitoring regulations may have a positive temporary impact on employment in the steel industry and will stimulate demand for laboratory services and flow measurement and sampling equipment. The monitoring database will be available to design cost-effective control programs aimed at eliminating toxic contamination where it occurs.

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1.0 BACKGROUND AND PURPOSE OF REPORT

1.1 MISA Objectives

The MOE's Municipal-Industrial Strategy for Abatement (MISA) is intended to achieve the "virtual elimination of toxic contaminants in municipal and industrial discharges into waterways."

The MISA program consists of three broad components:

1. Development and promulgation of Regulations which specify (a) contaminant monitoring requirements, and (b) effluent limits.

2. Development of these effluent limits based on "best available technology economically achievable" (BATEA) or water quality impacts.

3. Implementation of abatement programs and enforcement activities.

Economic assessments of each component of the MISA program are also being prepared. These assessments are intended to show the costs of the various regulations and other program elements and the economic and financial implications of these costs.

The MISA program will encompass at least 200 Ontario industrial establishments which discharge contaminants directly into waterways disaggregated into nine industrial sectors:

- petroleum refining
- organic chemical manufacturing
- pulp and paper
- iron and steel
- metal mining and refining
- industrial minerals
- electric power generation
- inorganic chemicals
- metal castings.

The first phase of the MISA regulatory program is the promulgation of monitoring regulations for all plants within each of the industrial sectors which discharge waste waters directly into the natural environment.

All direct dischargers are subject to a "General" and "Sector Specific" monitoring regulations. The

general regulation has been promulgated already and specifies monitoring requirements which apply to all industries. Sector specific regulations are currently being developed for each industry.

This investigation is part of the economic assessment component of the MISA program. The economic rationale, purpose and elements of the economic component of the program are discussed in the report "Economic Information Needs and Assessments for Developing MISA Monitoring and Abatement Requirements" (Ontario, March 1987).

1.2 Effluent Monitoring Regulation for Ontario's Iron and Steel Sector

Five companies with 7 steel mill locations are subject to the monitoring regulations for direct dischargers:

Ownership (as of Dec. 1988)	Plant	Location
Dofasco Inc.	Algoma Steel	Sault Ste. Marie
	Dofasco	Hamilton
Rio Algom Ltd.	Atlas Specialty Steels Division	Welland
IVACO Inc.	Ivaco Rolling Mills	L'Orignal
Co-Steel Inc.	Lake Ontario Steel Company Division (LASCO)	Whitby
Stelco Inc.	Stelco Steel Hilton Works	Hamilton
	Stelco Steel Lake Erie Works	Nanticoke

As noted, monitoring requirements for the iron and steel sector are specified in two regulations:

1. "Effluent Monitoring - General" which specifies common sampling, analysis, toxicity testing, flow measurement, recording and reporting protocols and procedures for all MISA sectors; and

2. "Effluent Monitoring - Iron and Steel Sector" which defines monitoring requirements specific to the iron and steel sector.

The "Effluent Monitoring - General" regulation was promulgated on June 7, 1988 and will continue in force for each MISA sector.

The Iron and Steel Sector Regulation will come into force five months and seven days after it is promulgated and continue in force during the subsequent 12-month period. It will be terminated, except for some weekly monitoring of conventional parameters, at the end of 18-months. Further monitoring requirements will then be specified in a subsequent "Effluent Limits Compliance Regulation".

The iron and steel sector has been divided into integrated iron and steel mills and specialty steel producers and mini-mills. Integrated mills such as Stelco, Dofasco and Algoma, include cokemaking, steelmaking, cold forming, hot forming and ironmaking processes, and generate most of the priority pollutants for this sector. Therefore they will sample their streams for a greater number of chemical compounds. Mini-mills such as IVACO Rolling Mills and LASCO and specialty steel producers such as Atlas Specialty Steels Division, generally purchase scrap metal which they melt to produce low carbon steel and specialty steel products. They typically use less water than integrated producers, because they do not produce raw steel in their process.

1.3 Purpose and Objectives of Present Report

This report is intended to present estimates of the potential incremental costs to the direct discharging iron and steel plants in Ontario of implementing the sector specific and general monitoring regulations. The economic effects and financial implications of these costs on the aggregate sector and individual firms will be analyzed where data are available. Financial data are not always available for specific plants, and the resulting analyses reflect this limitation.

The current monitoring regulation has gone through several iterations, resulting in a regulation that satisfies government objectives, industry concerns

and public representative suggestions. Evidence of the cost-effectiveness of the proposed requirements is revealed by comparing the costs associated with the proposed plant and process-specific requirements with:

- potential costs incurred under a more comprehensive across-the-board set of requirements.

This scenario may be interpreted as equitable in that all plants have to conduct the same number and kind of tests regardless of the manufacturing processes employed at each facility. These estimates show how much monitoring costs have been reduced by developing process-specific requirements for each plant.

A review of the physical and economic dimensions of the iron and steel industry in Ontario and Canada may be found in Coopers and Lybrand, 1987. Data from this report were used in the analyses found in Chapter 3.

1.4 Cost Estimation Procedure

Incremental costs of monitoring consist of recurring operating costs and one time capital and installation costs. In this report, capital and operating costs have been estimated for each monitoring function at each plant.

Steps involved in cost estimation include the determination of the activities and items that are required to implement each monitoring function, and the stated use of simplifying assumptions where necessary.

Cost estimates are based on specifications in the regulations. Some of the cost information was obtained from the individual plants through an industry representative. The industry representative distributed worksheets detailing the type of information required to all plants.

Information received from the individual plants varied in its detail. In addition to the worksheets, both Dofasco and Stelco provided reports detailing their intended expenditures to comply with the monitoring regulations. On the other hand, Algoma provided only summary information on operating and capital costs.

With the concurrence of industry representatives, the cost of analytical testing was estimated by assuming that all analytical testing will be performed by a commercial laboratory. Even though some plants have the ability to conduct many of the analyses on-site, this assumption was made to obtain comparable cost estimates for each of the plants. In cases where plants intend to do some or all of the testing in house, the analytical costs presented may be overestimated.

Single-valued or point estimates are presented, but should be treated with caution because inputs required for different types of monitoring functions are often uncertain. Moreover, there is some flexibility as to how individual plants may implement some of the monitoring requirements.

For the above reasons, ranges of costs are estimated for each monitoring function.

All cost estimates are expressed in 1988 dollars.

1.5 Pre-Regulation Consultation and Meetings

Industry representatives from the iron and steel sector spent time at meetings and review committees in order to participate in the development of the regulations.

Industry representatives reported they spent an estimated 420 hours in meetings with the Iron and Steel Sector Joint Technical Committee (JTC) and its Analytical and Regulation Subcommittees over a 12-month period. In addition, iron and steel company staff devoted about 450 hours to complete monitoring tasks while 570 persons-hours were involved in regulation writing meetings. In total, just over 1,440 person-hours were spent for pre-regulation assessments, consultation and meetings.

Participation in these meetings may represent an opportunity cost in terms of time spent away from regular business. According to industry representatives, the charge out rate for these individuals ranges from $40 to $70 per hour. Valued in terms of these rates, the cost of pre-regulation consultation and meetings would range from $57,600 to $100,800, not including transportation.

2.0 MONITORING COST ESTIMATES

2.1 Regulation Requirements

The General Effluent Monitoring Regulation specifies requirements for five major monitoring activities which each wastewater discharger must implement to various degrees and levels of effort.

1. Sampling requirements
2. Analytical requirements (characterization and routine analyses)
3. Toxicity testing
4. Flow measurement
5. Reporting

Seven types of effluent streams or "sampling points" are defined in the specific Regulation for the iron and steel sector.

1. Process sub-category effluent
2. Final effluent
3. Cooling water streams
4. Waste disposal site effluent
5. Stormwater streams
6. Emergency overflow
7. Storage site effluent

The monitoring schedules for the iron and steel sector which can be found in the sector-specific regulation, differ by plant according to the type of effluent stream and the manufacturing processes found at the plants. All plants that utilize identical manufacturing processes such as cokemaking, ironmaking, etc. must test for the same compounds, at the same frequency.

The 7 plants have 55 sampling points. As shown in Table 1, plants utilizing similar manufacturing processes generate approximately the same number of effluent streams. The 3 large integrated steel mills with the exception of Stelco-Erie, which utilize blast furnaces, test approximately the same number of effluent streams, 10-14. Similarly, mini-mills which utilize electric arc furnaces to melt scrap steel generate 3 to 4 effluent streams which require monitoring and the specialty mill generates 8 streams.

TABLE 1

NUMBER AND TYPE OF EFFLUENT STREAM BY PLANT AND MILL TYPE

INTEGRATED STEEL MILLS

EFFLUENT STREAM	STELCO		DOFASCO	ALGOMA	TOTAL
	HILTON WORKS	LAKE ERIE			
Process Sub-category	0	1	5	4	10
Final Effluent	4	1	3	2	10
Cooling Water	3	0	2	7	12
Waste Disposal Site	0	1*	0	0	1
Stormwater	1	1	1	1	4
Emergency Overflow	1*	0	0	0	1
Storage Site Effluent	0	1	1*	0	2
TOTAL	9	5	12	14	40

MINI-MILLS AND SPECIALTY STEEL MILL

EFFLUENT STREAM	ATLAS	IVACO	LASCO	TOTAL
Process Sub category	2	1*	0	3
Final Effluent	1	1*	1	3
Cooling Water	1	1	0	2
Waste Disposal Site	1*	0	1*	2
Stormwater	1	1	1	3
Emergency Overflow	2*	0	0	2
Storage Site Effluent	0	0	0	0
TOTAL	8	4	3	15

Source: The Effluent Monitoring Regulation for the Iron and Steel Sector, March 1989

* These streams are to be tested on an event basis.

2.2 Sampling Requirements

Sampling protocols and specifications are defined in Section 3 of the "Effluent Monitoring - General" regulation.

This function involves taking water samples from designated sampling points, collecting the samples, storing them under refrigeration where necessary and then transporting the samples to lab facilities within a prescribed time period. Samples must be taken for characterization, routine analyses and for biological tests.

Samples may be taken by hand under the prescribed frequency or by means of automatic sampling equipment. By whatever means they are collected, samples must then be taken to a facility for preparation and, if necessary, for refrigerated storage.

Operating expenditures for sampling are based on the following components:

- vehicle leasing;
- transportation within plant and to laboratories;
- operation and maintenance of sampling devices; and
- personnel required either for manual sampling or for collection of samples.

Five of the seven plants reported that they would require a vehicle for the collection of samples within the plant and to the laboratory. An estimate of $6,000 to lease a vehicle was used.

In plant transportation costs were based on estimated travel distances supplied by the companies valued at a government rate of $.275 km. In plant transportation costs are minimal and range from $10 to $3,413 per year per plant.

Transportation costs to laboratories were derived by taking the round trip distance between each plant and a commercial laboratory in Toronto and multiplying by the number of trips to the lab. This resulted in additional 11,328 to 218,400 km per year. Using $.275 km, this results in an additional annual vehicle operating cost of $3,115 to $60,000 per plant. Algoma steel's transportation costs were significantly higher than the other mills due to their distance from Toronto.

It is likely that Algoma will not actually incur these large transportation costs, but rather will conduct most sampling in-house and try to obtain additional analytical services in northern Ontario.

Operation and maintenance of sampling devices were based on the following:

- Dofasco, Stelco and Atlas estimated $3,750 per sampler per year.
- Algoma estimated $100,000 for 10 samplers.

Lastly, the plants estimated personnel requirements for the collection of samples and recording of data.

Company representatives provided estimates of the number of hours to complete both sampling and flow measurement activities. The estimated time to complete these activities annually ranged from 56 to 4,126, hours for the 12 month period.

The wage rates cited for relevant personnel ranged from $16.80 to $40 per hour. In order to provide more comparable estimates, a median wage rate of $20 per hour was applied to the time supplied by each firm. Personnel costs for 6 of the plants ranged from $2,240 to $220,000.

Algoma Steel did not provide a breakdown of their personnel costs. Stelco proposed that 2 two-man teams would be required at the Hilton Works plant, at an annual salary of $55,000. Stelco indicated that two-man teams may be required due to safety reasons.

In total, operating costs for sampling range from $5,400 to $264,561 per plant per year, with a point estimate of $769,948 for the sector. These operating costs are summarized in Table 2. The range of costs per plant reflects primarily the number of effluent streams that must be sampled at each plant. The four integrated steel mills account for 84% of these costs.

Table 2

OPERATING COSTS - SAMPLING
('000)

COMPONENT	DOFASCO	STELCO ERIE	STELCO HILTON	ALGOMA	ATLAS	LASCO	IVACO	TOTAL
Operation and Maintenance	45	11	30	100	15	4	0	205
Vehicle Leasing	6	6	6	0	6	6	0	30
Personnel	83	55	220	0	40	33	2.2	433.2
Transportation								
in plant	0.2	0.5	3.4	0.2	0.2	0.2	0.01	4.71
to Lab	5.1	10.3	5.1	60	8.6	4.3	3.1	96.5
TOTAL	139.3	82.8	264.5	160.2	69.8	47.5	5.3	769.4
% of Total Operating Cost	18%	11%	34%	21%	9%	6%	1%	100%

Source: Industry Estimates

Capital expenditures for sampling may include equipment, installation and construction costs.

Equipment that may be required include automatic samplers, refrigeration units for the automatic samplers and for storage, insulated enclosures and transmission systems.

Installation costs of a sampling facility, which include temperature recorders, electrical supply, signal cables and construction are sensitive to site specific circumstance and amount to as much as two times the equipment cost. All firms with the exception of Dofasco, aggregated installation costs with equipment. Dofasco presented separate estimates for installation and equipment.

Table 3 below shows the number of sampling points and the corresponding number of sampling devices, firms intend to install. IVACO intends to sample all effluents manually, therefore, does not require an automatic sampling device.

TABLE 3

SAMPLING DEVICES REQUIRED BY PLANT

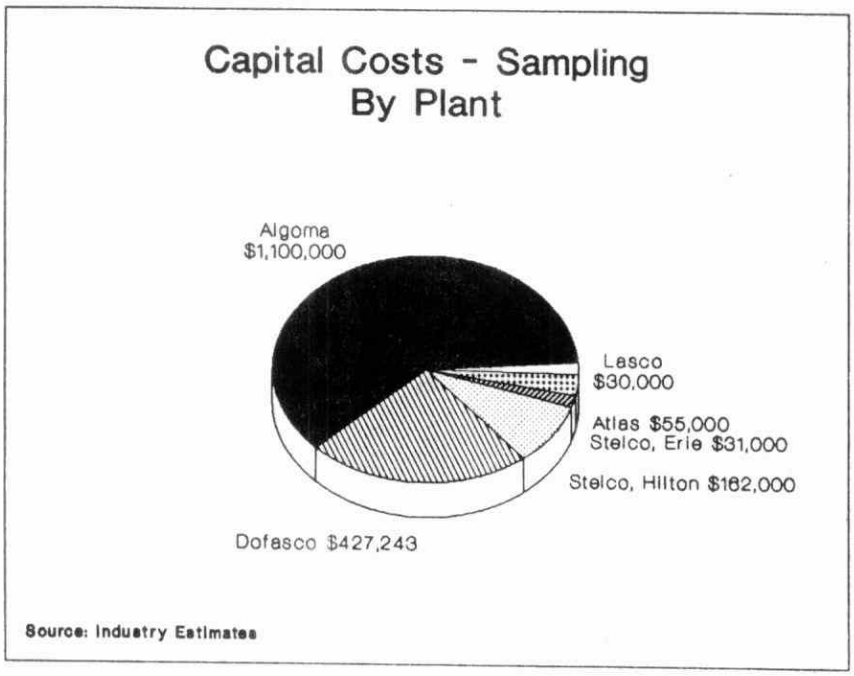
Company/Plant	# of Sampling Points	# of Sampling Devices Required
Algoma	14	N/A
Atlas Specialty Steels	8	8
Dofasco	12	12
Ivaco	4	0
Lasco	3	3
Stelco - Hilton	9	8
Stelco - Lake Erie	5	3
TOTAL	55	34

Source: MOE, Water Resources Branch, 1988, Industry representative.

Capital costs were supplied by each plant and reviewed by MOE technical staff. As shown in Figure 1 below, the costs range from $0 to $1,100,000 per plant. This wide divergence is due primarily to the number of devices which plants intend to install, and costs associated with installing the devices. The estimates reported by Stelco and Dofasco include power, plumbing and sitework costs. Algoma estimated a cost of $100,000 per sampling point which included the cost of a building, power and a sampler.

In addition, Dofasco, Stelco and Atlas reported estimates for buildings required to house the sampling and the flow measurement devices. Although Atlas indicated that they would require a building, no cost estimate was given. An estimate of $12,000 was made based on Dofasco's lowest estimate for a pre-fabricated building. The cost allocated to buildings was estimated at approximately $234,000 for the 4 plants.

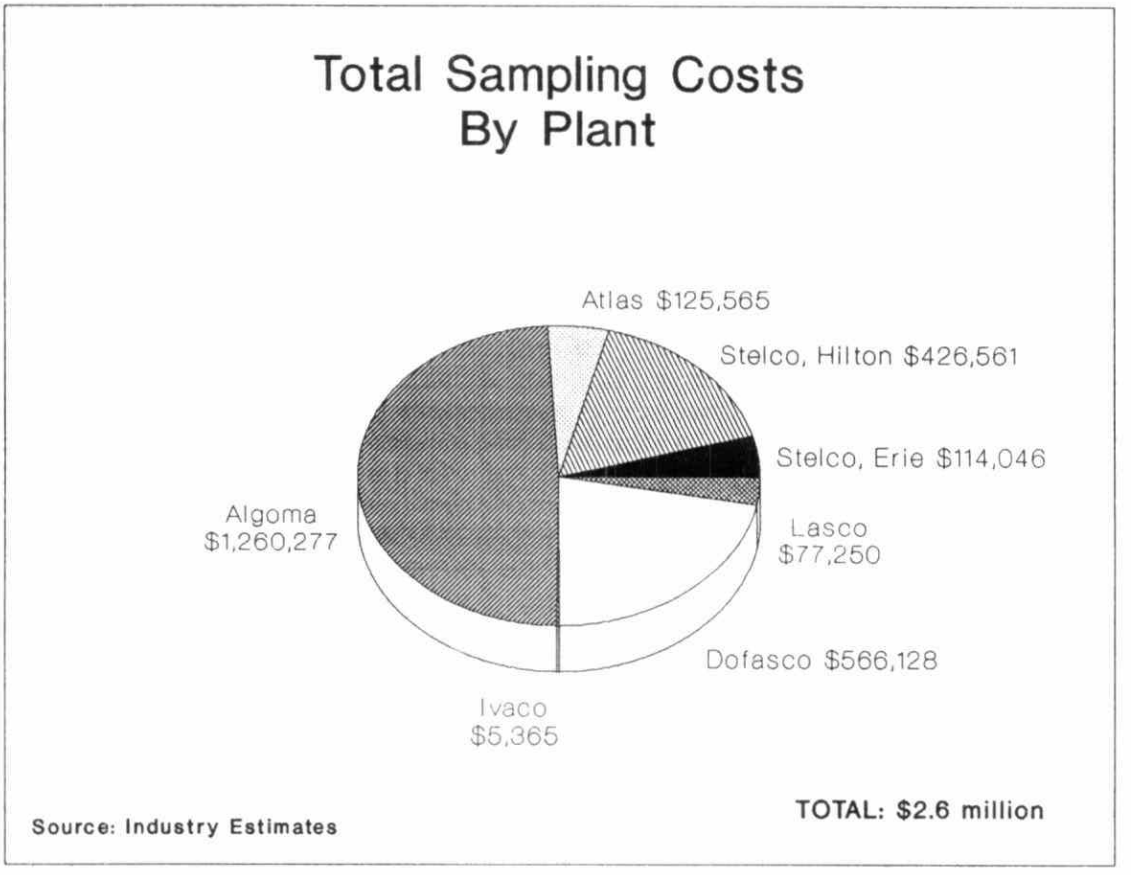
FIGURE 1



The point estimate of the capital expenditure for sampling for the sector is $1.8 million. Industry representatives indicated that capital costs could vary from ± 30 to 50%. Using an average factor of 40%, capital costs for the sector could range from $1.08 to $2.5 million.

Based on the foregoing discussion, the total cost for sampling activities including both operating and capital are estimated to range from $1.8 to $3.2 million for the sector. The breakdown of total sampling costs per plant is shown in Figure 2.

FIGURE 2



2.3 Flow Measurement

Flow measurement is required to allow accurate calculation of total loadings of contaminants discharged to the environment.

Flow measurement requirements at each type of sampling point are summarized in Table 4.

Installation costs will vary among plants due to site-specific characteristics such as the volume of effluent flow, location of pipes, etc.

A study has been commissioned by the MOE to identify necessary flow measuring devices and to provide order of magnitude cost estimates. At this writing, final cost estimates were not available for analyses or for inclusion into this report.

Capital costs of flow measurement facilities used in this report, were supplied by each plant and reviewed by MOE technical staff. Capital costs for flow measurement equipment and installation range from $4,000 to $1,544,630 per plant. This large range primarily reflects the difference in the number of effluent streams measured by the large integrated mills compared with the mini-mills. The number of streams that require measurement directly impact on the number and type of devices companies intend to install.

IVACO, for example, indicates that they are going to install one totalizing metre at a cost of $4,000. On the other hand, Dofasco intends to install devices at all but one of their effluent streams at costs ranging from $3,000 to $60,400 per device. As noted in Section 2, Dofasco's estimates include sitework, plumbing and power requirements. These installations are estimated to total $1,467,640 for all 12 effluent streams. Similarly, Stelco included the cost of sitework, plumbing power and building requirements in their estimates of flow measurement.

The point estimate of the capital cost for flow measurement for the sector is $3.3 million. Estimates by plant are summarized in Table 5. Using a factor of +/-40%, capital costs could range from $2.0 to $4.6 million. The 3 integrated steel producers account for 94% of the total capital costs for flow measurement.

TABLE 4

REQUIREMENTS FOR FLOW MEASUREMENT UNDER THE
IRON AND STEEL MANUFACTURING EFFLUENT MONITORING REGULATION

Outfall Type	Flow Measurement Requirements	Accuracy
Process Sub-category	Continuously	+/-7% actual flow - new equipment +/-15% actual flow - existing equipment
Final	Continuously measured	+/-20% of actual flow
Cooling Water	Measured or estimated flow at the time of sampling	+/- 20% of actual flow
Storage Site Effluent	Measured or estimated flow at the time of sampling	+/- 20% of actual flow
Stormwater	Measured or estimated flow at the time of sampling	+/- 20% of actual flow
Waste Disposal Site Effluent	Volume and duration of each discharge event	+/- 20% of actual flow
Emergency Overflow	Event duration and approximate volume of discharge	+/- 20% of actual flow

Source: Effluent Monitoring Regulation - Iron and Steel Sector, 1988;
Effluent Monitoring Regulation - General (Section 6), 1988.

Operation and maintenance costs reported by the plants range from $0 for Atlas, to $81,000 for Dofasco with a point estimate of $200,238 for the sector. Both Dofasco and Stelco stated that maintenance of each final flow measurement devices would cost $1000 per month, while devices at all other streams would require about $1,500 per month.

The total point estimate for both capital and operating expenditures is $3.5 million. Using the +/-40% factor for capital costs, total costs for flow measurement could range from $2.1 million to $4.9 million.

The breakdown of these estimates per plant is shown in Table 5 below.

Cost estimates for the four integrated mills represent 94% of the total flow measurement costs.

TABLE 5

FLOW MEASUREMENT

ESTIMATED CAPITAL AND OPERATING COSTS ('000)

	CAPITAL COSTS	% of Total	OPERATING COSTS	% of Total	TOTAL
DOFASCO	1,545	47	81	40	1,626
STELCO-ERIE	237	7	12	6	249
STELCO-HILTON	1,050	32	51	26	1,101
ALGOMA	250	8	50	25	300
ATLAS	30	1	0	0	30
LASCO	175	5	4	2	179
IVACO	4	<1	2	1	6
TOTAL	3,291	100	200	100	3,491

2.4 Analytical Testing

As noted earlier, it is assumed that characterization, toxicity testing, and routine analyses will be performed by a commercial laboratory, even though some plants have the ability to conduct many of the analyses on-site. This has been done in order to obtain comparable cost estimates for each of the plants.

Analytical testing requirements are specific to the manufacturing processes employed at the iron and steel mills. Consequently, analytical requirements for the integrated mills are more stringent than for the smaller mini-mills.

Analytical testing which includes characterization, routine and toxicity represents the largest component of the incremental operating costs associated with monitoring, amounting to 68% of the total operating cost of monitoring for the sector.

The cost of analytical testing was estimated for the 12 month period of the regulations and is based on laboratory test prices listed in Table 6. This table originates from a survey of laboratories in Ontario, Quebec and the U.S. (MOE, Laboratory Services Branch, 1988). The 27 test groups listed contain about 150 individual chemicals. However, effluent samples from Iron and Steel mills will not be tested for all of the chemicals listed.

Prices of laboratory tests include quality assurance/quality control (QA/QC) samples and the preparation of required reports.

The listed prices may overstate the true costs because volume discounts are likely to apply, given the extent of MISA testing. In addition, the price of testing a single chemical which is part of a larger Analytical Test Group may be less than is indicated as the price for the entire group.

There is also the possibility that the prices may understate the costs. Recent follow-ups to the survey suggest that lab prices may be increasing rapidly in the face of rising demand.

Some effluent streams which are not continuous will be tested on an "event" basis. These streams include waste disposal sites, emergency overflow and storage sites. The Iron and Steel regulation requires that the storage site effluent and waste disposal site runoff be tested at most 12 times per year.

The following cost estimates for "event" tested streams are based on the frequencies reported by the individual plants. Where frequencies were not supplied, the maximum number of events as allowed in the regulation was applied.

TABLE 6

LABORATORY TEST PRICES FOR ANALYTICAL TEST GROUPS

No.	Analytical Test Group	Price ($)			
		Low	Median	Average	High
1.*	Chemical Oxygen Demand	14.00	26.00	29.78	70.00
2.	Cyanide	10.00	32.50	36.10	100.00
3.	Hydrogen Ion (pH)	1.30	5.75	6.84	30.00
4a.	Amonia Nitrogen plus amonium Total Kjeldahl Nitrogen.				
4b.	Nitrate	40.00	55.60	86.99	230.00
5.	Organic Carbon	10.00	50.00	57.03	130.00
6.	Total Phosphorus	8.75	20.00	25.12	120.00
7.	Conductivity	2.50	8.00	9.44	45.50
8.	Total Suspended Solids (SS)				
	Volatils Suspended Solids (VSS)	5.00	13.00	14.87	45.50
9.	Metals (13 metals)	10.00	-	84.10	491.40
10.	Hydrides (Arsenic only)	7.00	20.00	23.33	80.00
11.	Chromium (Hexavalent)	5.00	19.00	20.47	53.30
12.	Mercury	7.00	25.75	25.77	85.00
13.*	Total Alkyl Lead	39.00	93.75	172.00	420.00
14.	Phenolics (4AAP)	19.50	35.00	42.93	130.00
15.	Sulphide	-	-	30.00	-
16.	Volatiles, Halogenated	83.00	226.25	239.90	1,020.50
17.	Volatiles, Non-Halogenated	85.00	200.00	176.81	435.50
18.*	Volatiles, Water Soluble	50.00	195.00	126.50	325.00

TABLE 6

LABORATORY TEST PRICES FOR ANALYTICAL TEST GROUPS

No.	Analytical Test Group	Price ($)			
		Low	Median	Average	High
19	Extractables, Base Neutral	100.00	355.00	427.49	1,560.00
20.	Extractables, Acid (Phenolics)	65.00	260.00	245.68	780.00
21.*	Extractables, Phenoxy Acid Herbicides	85.00	185.00	188.09	360.00
22.*	Extractables, Organo-chlorine Pesticides	100.00	205.00	270.14	975.00
23.	Extractables, Neutral Chlorinated	105.00	200.00	232.04	900.00
24.	PCDDs & PCDFs	325.00	1,000.00	1,228.27	2,600.00
25.	Oil & Grease	15.00	30.00	36.00	125.00
26.	Fatty Acids & Resins	15.00	143.75	133.18	350.00
27.	PCBs (Total)	40.00	105.00	103.90	240.00
28a 28b 30	Open Scans	-	-	500.00	-

Source: Inventory and Critical Review of Laboratory Resources, Toronto. Laboratory Services Branch, Ontario Ministry of the Environment, 1988.

* These analytical groups are not in the iron and steel sector list for testing.

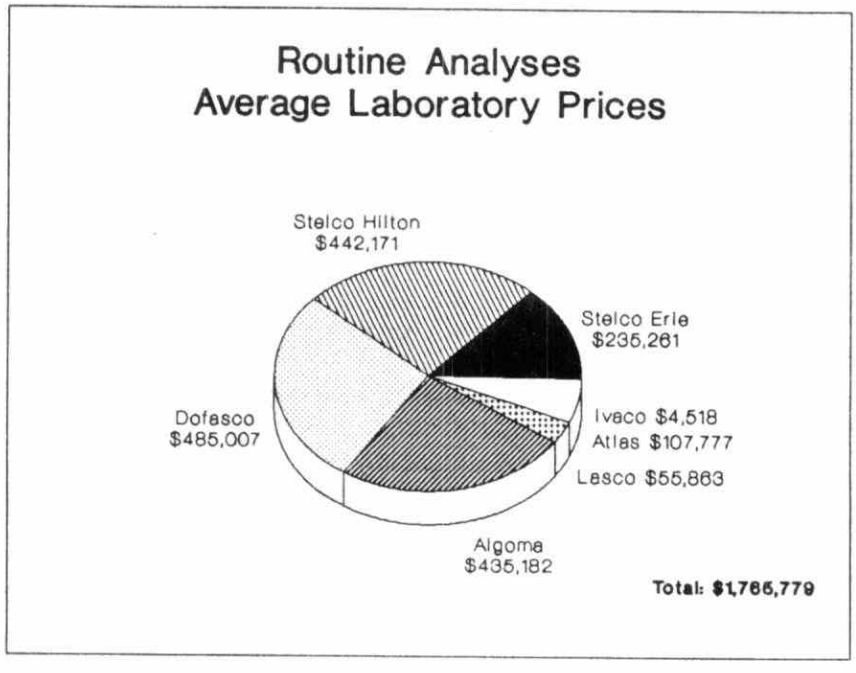
2.5 Routine Analyses

Routine analyses involve testing of samples for individual chemical compounds taken at three frequency levels - daily, three times per week, monthly, plus on an event basis.

Figure 3 below shows the cost of routine analyses per plant using average laboratory test prices.

The annual cost of routine analyses ranges from $4,518 to $485,007 per plant, per year with a total point estimate of $1,765,779 per year. These estimates exclude transportation. Routine analyses for the 4 integrated mills amounts to 91% of the total costs.

FIGURE 3



2.6 Characterization Analyses

Characterization analysis is a procedure which identifies the presence or absence of specified chemical species or analytical test groups in an effluent stream.

Each iron and steel sector plant will have to characterize its final and cooling water effluent streams for analytical test groups listed on the plant specific schedules found in the regulation. The iron and steel sector regulation specifies two frequencies for characterization; quarterly, and semi-annually. In addition, if there is a process change that may adversely affect the quality of the final effluent, characterization is required within 30 days. To the extent that specific parameters are already routinely tested, then additional characterization analyses will not be required. Open characterization is also required.

Open characterization attempts to analyze other compounds that may be present on a qualitative basis with a detection limit of 1 to 10 ppb. Four open characterizations will be analyzed.

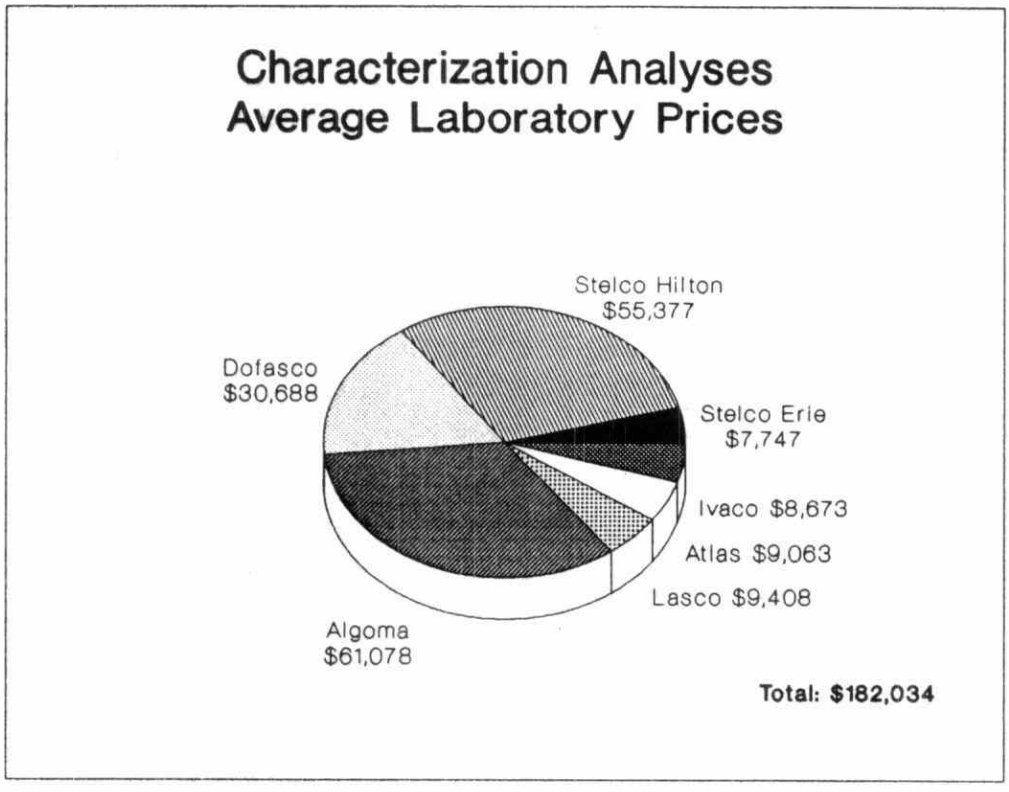
Different characterization requirements have been specified for integrated iron and steel mills than for specialty steel producers and mini-mills.

Cyanide, mercury, phenolics and sulphide are not included on the specialty steel and mini-mill characterization list because they are not produced by nor introduced to specialty steel and mini-mill processes and operation.

Figure 4 summarizes annual characterization costs for the average and low price scenarios, excluding transportation, per plant. Characterization costs range from $7,747 to $61,078 per plant using the average lab prices.

Total annual cost of characterization for the iron and steel sector amounts to approximately $182,034. Again, integrated steel producers account for the bulk of these costs, 85% of total costs.

FIGURE 4


Characterization Analyses
Average Laboratory Prices
Stelco Hilton
$55,377
Dofasco
$30,688
Stelco Erie
$7,747
Ivaco $8,673
Atlas $9,063
Lasco $9,408
Algoma
$61,078
Total: $182,034

These cost estimates do not include pre-regulation characterization analyses. While not specifically required by the regulation, pre-regulation monitoring work was carried out in anticipation of the MISA monitoring activities and is deemed to be a cost of the MISA program.

2.7 Toxicity Testing

Biological toxicity testing involves the use of the static 96-hour rainbow trout toxicity test and a 48-hour Daphnia magna (a small invertebrate crustacean) mortality (acute lethality toxicity) test.

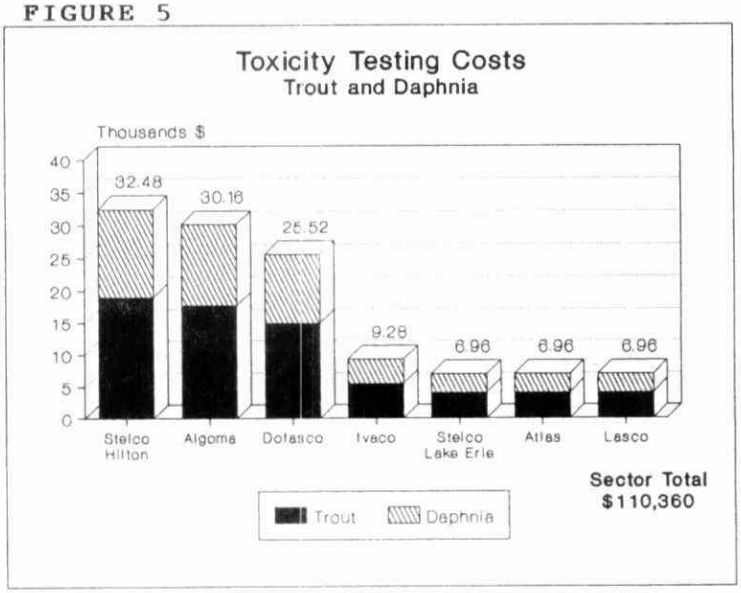
Final effluents will be tested monthly for trout and Daphnia Magna, while cooling water streams will be tested quarterly. Toxicity testing costs are based on the following prices for a full dilution series:

Trout: $360 per test
Daphnia: $240 per test

These prices do not include costs of collecting samples or transport to a laboratory.

Using these prices, the total annual cost for toxicity testing is $110,360 for the sector. The estimates per plant for each test are shown in Figure 5 below.

FIGURE 5



2.8 Reporting

Monitoring data will have to be assembled, recorded, stored, and reported to company management and to the Ministry of the Environment.

Data storage and manipulation will require an AT personal computer together with compatible peripherals and software, plus personnel dedicated to perform report generation functions.

Cost estimates for reporting as supplied by individual plants range from $0 up to $50,000, totaling $139,385 for the iron and steel sector (See Appendix A).

This wide range is due to the fact that Dofasco, Stelco and Atlas indicated the need for additional computer facilities and some firms did not report costs for data entry.

The wage rates cited for data entry personnel ranged from $16.80 to $40/hr per plant. In order to provide more comparable estimates, a median wage rate of $19.23 was applied to the time supplied by each firm.

Finally, some plants reported that supervision would be required for sample collection or data entry and other monitoring activities. Again, wage rates for supervision varied widely and a median rate of $24.00 was used. For the 5 plants which reported supervision, costs ranged from $624 for IVACO to $49,920 for Dofasco, totalling $107,340 for the sector.

2.9 Intake Water

Another potential sampling point is intake water. The General and Iron and Steel Monitoring Regulations do NOT specify monitoring requirements for intake water. However, plants which obtain water from large surfacewater sources which in turn receive the wastewater discharges of other municipalities and industrial plants have an incentive to sample their intake water. Data on intake water quality would permit the firms to determine how much of a contaminant is generated by the plant and how much was already contained in the wastewater.

Estimates provided by the industry include testing of intake water for the chemicals or test groups that are subject to routine analyses. These estimates are on based laboratory prices used in the "Cost Estimates and Implications of the Effluent Monitoring-General" and "Effluent Monitoring Petroleum Refining Sector Regulations for Ontario's Petroleum Refineries". (MOE, July 1988). These prices vary slightly from those found in Table 3 but are derived from the same data source (Dillon, 1988). Estimates were received from Atlas, Stelco-Erie, Stelco-Hilton, Dofasco and were $68,271, $89,130, $97,397 and $165,736, respectively.

2.10 Total Estimated Costs of the MISA Iron and Steel Sector Monitoring Requirements

Appendix A presents a summary of the estimates of operating and capital costs for each monitoring function for each plant. Costs associated with intake monitoring and contingencies are also included in this table.

Using a factor of +/-40%, total capital costs for the sector range from $3.0 to $7.1 million with a point estimate of $5.1 million. Capital costs are presented as a range because there is some flexibility as to how the companies comply with the regulation.

- Capital costs for flow measurement represent the largest expenditure, accounting for 65% of total capital costs, while sampling accounts for 35%. Reporting costs were minimal and accounted for less than 1% of the capital costs.

Based on prices for laboratory tests shown in Table 6 total annual operating costs for the sector are estimated at $3.3 million.

- Analytical testing accounts for the largest proportion of the estimated operating costs 63%, followed by sampling accounting for 24%, reporting and administration 7% and flow measurement the remaining 6%.

The costs for Analytical testing were based on the assumption that all plants transport samples to a laboratory for testing. It is reasonable to expect that the actual costs would be somewhat lower than indicated for those firms which have the capability to conduct sampling in-house.

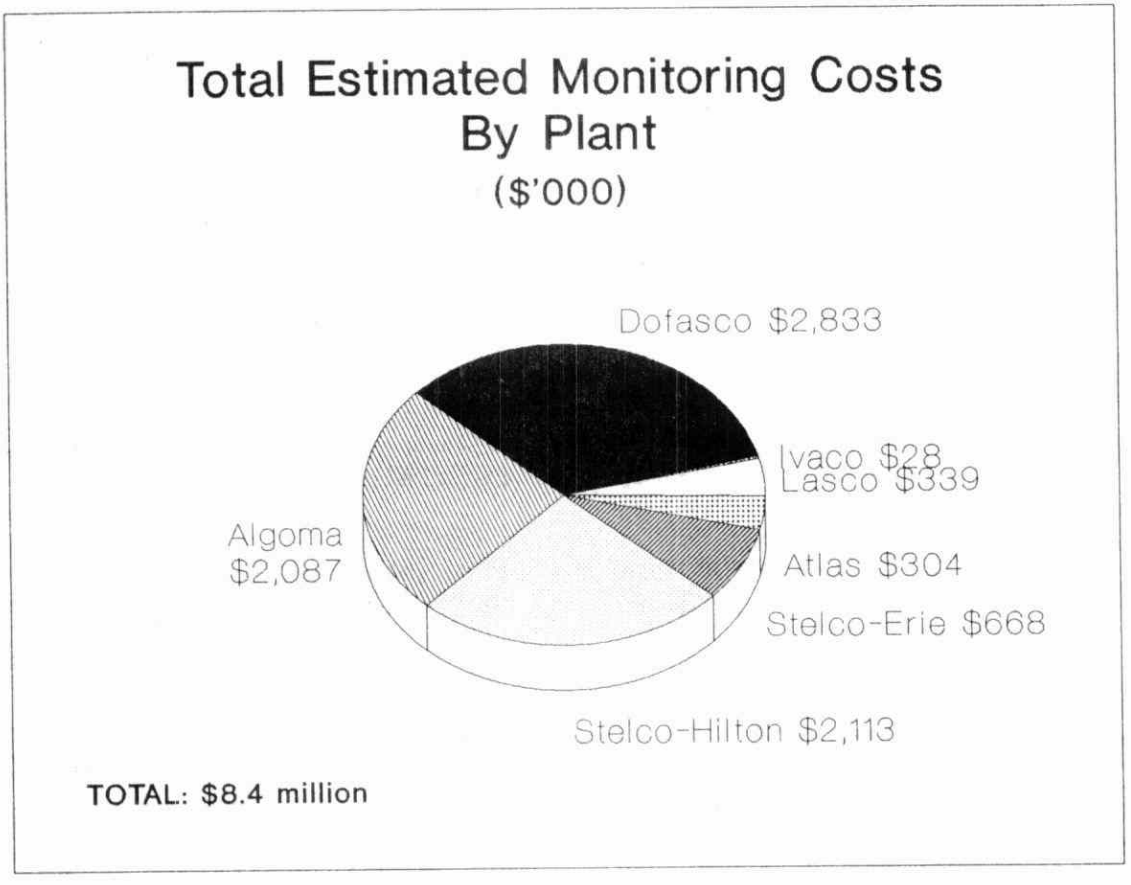
The total estimated incremental cost of the MISA monitoring requirements for the iron and steel sector ranges from $6.3 to $10.4 million. This does not include estimated intake water monitoring costs, nor contingencies.

- Capital expenditures account for over 62% of the total estimated monitoring costs. As previously noted, due to uncertainties, capital costs could vary as much as ± 40%.

The 4 large integrated mills, Dofasco, Stelco-Erie, Stelco-Hilton and Algoma, account for 92% of the total monitoring costs.

Figure 6 below presents a breakdown of the total monitoring costs by plant. A further breakdown in the costs by monitoring function can be found in Appendix A.

FIGURE 6



2.11 Alternative Estimates of Routine Monitoring Costs

The Iron and Steel Sector Regulation specifies process specific testing requirements. If, however, the same parameters were tested at the same frequency in all plants, as in the refining sector, the cost burdens would differ. This scenario could be viewed as more "equitable" in that all plants would be subject to the same generic testing schedule.

Routine monitoring costs were estimated for this "equitable" scenario in order to illustrate the cost effectiveness of having process-specific requirements. The following assumptions were used:

1. The iron and steel sector plants subject to the MISA regulations would have to monitor all of their process subcategory and final effluent streams thrice weekly for contaminants specified for all of the manufacturing processes in the regulation.

2. The estimates are based on average laboratory prices as shown in Table 6.

The implications of this scenario for other monitoring functions were not calculated because the costs for these activities would change slightly. The largest difference would occur in routine analyses which are estimated below.

This "equitable" scenario resulted in routine monitoring costs ranging from $.16 to $1.3 million per plant, with a point estimate of $4.6 million for the entire iron and steel sector. This compares to the total estimated routine monitoring costs, of the proposed regulation of $1.8 million.

Estimates of the two scenarios are compared in Table 7. The manufacturing process-specific requirements under the proposed regulation is estimated to cost to $2.8 million less than the "equitable" scenario.

This difference is a measure of the cost-effectiveness of the process specific approach proposed for the iron and steel sector. The MOE has been cognizant of the potential financial implications of the MISA requirements, and has incorporated such considerations in the development of the monitoring regulations.

TABLE 7

ALTERNATIVE ROUTINE MONITORING COST ESTIMATE
($)

PLANT	PROPOSED	"EQUITABLE"	DIFFERENCE	% SAVINGS
Algoma	435,182	989,640	554,458	56%
Atlas	107,777	499,921	392,144	78%
Dofasco	485,007	1,322,415	837,408	63%
IVACO	4,518	479,127	474,609	99%
LASCO	55,863	160,326	104,463	65%
Stelco-Erie	235,261	333,006	97,745	29%
Stelco-Hilton	442,171	848,523	401,876	47%
TOTAL	1,765,779	4,632,958	2,867,179	62%

3.0 ECONOMIC EFFECTS AND IMPLICATIONS OF MONITORING COSTS

3.1 Analytical Procedure

In this section, some of the key effects of the incremental monitoring costs on the iron and steel sector as a whole, and on individual firms within the sector, will be examined.

The sectoral analysis will examine how these extra costs may impact on international and provincial competitiveness, employment and profitability.

Using publically available data, assessments of the implications of the MISA monitoring costs to the sector and each individual firm are made in relation to the following financial performance measures:

- capital expenditures;
- after-tax earnings;
- operating costs per tonne of production; and
- return on capital employed.

Ideally, the impacts of the incremental costs of monitoring should be analyzed against the projected future values of the above mentioned financial measures. However, because such projections were unavailable, the costs have been assessed against historical data over the period 1981-1987. In order to reflect the cyclical nature of the steel industry, the lowest year and highest year in this period in terms of capital expenditures and after-tax earnings will be used as benchmarks to ascertain the effects the regulations could have during an upturn and downturn in the business cycle.

Monitoring costs are assumed to impact the company in the following ways:

- operating costs of monitoring will increase the firm's annual operating expenses and thus reduce before-tax earnings unless there is some offsetting increase in productivity associated with wastestream monitoring. A conservative estimate of the effect will be made by comparing operating costs with after-tax earnings;

- capital costs of monitoring will require firms to divert funds from other purposes. Capital costs would normally be depreciated over 3 to

5 years. Only a proportion of the capital costs should, therefore, be deducted from profits or earnings each year. However, to be conservative, it will be assumed that capital costs are fully deducted in the 12-month period.

The extra costs may reduce the firms' investment competitiveness if they are not able to pass these costs on as higher prices. This point will be examined by determining the proportion these costs are to average revenues and average production costs.

Financial data are seldom available at the plant level although it is at this level that financial consequences will usually influence decisions or affect the viability of an operation. Dofasco was the only company to respond to the MOE's request for plant specific financial information. For all other firms, assessments and comparisons were made using publically available financial aggregated at the company level.

Where steelmaking represents a large proportion of the company's business operations, as in the case of Stelco Inc., Algoma Steel Corp., and Co-Steel Inc. (LASCO) using publically available data will provide an accurate account of the impact of monitoring on the plants. However, for companies whose interests are diversified, and where the iron and steel plants represent a small proportion of business ventures, as in the case of IVACO Inc., (IVACO Rolling Mills) and Rio Algom (Atlas Specialty Steels Division) use of consolidated company data may not reveal the true impacts of the monitoring costs on these plants.

3.2 State of the Industry and Outlook

As discussed in the Industry Profile - Iron and Steel (Coopers and Lybrand, 1987) and Industry Profile (DRI, 1988), Ontario firms in the Iron and Steel Sector can be characterized by some basic features.

- Ontario steel makers are not price setters. They are generally price-takers in international markets.

- because there are only few firms in the Ontario industry, three of which are very large, the current market structure can be described as oligopolistic competition.

- plants are very capital intensive so that entry and exit is very expensive. The industry is not characterized by new extrants.

- firms operate in a very competitive global marketplace.

- firms operate in an industry where the demand for steel is highly correlated with economic conditions so that steel markets are cyclical

The Canadian iron and steel industry can be segregated into large integrated steel mills serving national markets, and smaller mini-mills serving regional markets. Ontario accounts for over 75% of Canada's steel making capacity and is home to Canada's largest integrated steel mills, Dofasco Inc., Stelco Inc., and Algoma Inc. Internationally, these mills compete with producers in the United States, Argentina, Brazil, Germany, Japan and Korea (DRI, 1988).

In recent years, the curtailment of worldwide demand for steel products and the entrance of developing countries with steel making capacity has exerted downward pressure on steel prices. Some of the decrease in demand for steel products has been caused by slower economic growth, the substitution of steel by other materials, and the decreasing intensity of steel use in the automotive industry (Coopers and Lybrand, 1987).

Because iron and steel plants sell to competitive markets, they cannot easily pass on additional costs in higher prices unless all other firms are subject to the same costs. Seven plants will bear monitoring costs initially out of 9 that operate in the province. These 7 plants are reported to directly discharge into wastewater streams.

As with other industries, iron and steel plants are facing increasingly stringent environmental regulations in virtually all industrial nations. Steel firms in the U.S. have been operating under "Best Practical Technology" (BAT) Effluent Limitation Guidelines since May 1982. While it is difficult to compare environmental requirements and its enforcement from one nation to another, it is

fair to say that most steel producing nations are imposing similar pollution control requirements with respect to air and waste.

The Ontario steel industry has recovered from the recession of the early 1980's. Industry profits have improved and firms are beginning to undertake capital expenditure programs that were put on hold during the recession.

The outlook for the steel industry depends on general conditions of the economy. In the short term, growth is expected to remain fairly strong, as business investment in plant and equipment keeps domestic demand at high levels. In the medium term, steel demand related to oil, gas and agricultural markets will continue to be weak. The construction and automotive sectors are expected to slow down which will have a negative impact on the steel industry. (Toronto Dominion Bank, 1988)

The Free Trade Agreement (FTA) calls for the elimination of Canadian and U.S. duties on steel over a 10 year period. Current tariffs in the United States are four to five percent, compared to Canadian tariffs of eight to ten percent (DRIE, 1988). In addition the FTA covers rules of origin, dispute settlement mechanisms, safeguards and quantitative restrictions in the steel industry.

It is not clear how the FTA will effect the Canadian steel industry. Canadian steel companies support the FTA arguing that the FTA will ensure secure access to the United States market. However, the Premier Council's Report and preliminary analyses from MITT suggest that under the FTA access to the U.S. market will remain virtually unchanged. They argue that Canadian steel exports to the U.S. are not expected to grow but will remain close to their current levels.

The Canadian Steel industry could benefit from the agreement with respect to Agreed Rules of Origin. In the past Canada was used as a back door to the U.S. market by off-shore steel producers. Under the rules of origin it will be easier to distinguish between steel produced in Canada and abroad and therefore ensure that benefits of the agreement apply only to products which validly originate in Canada or the United States.

3.3 Sector Economic Impact

In this section, "Sector" is defined as the 7 iron and steel plants subject to the MISA regulations.

Return on capital employed is a measure firms use to assess competing investment opportunities. The incremental capital costs of monitoring did not significantly affect the ratio for any of the plants nor for the sector as a whole.

The average annual capital expenditure for the iron and steel sector from 1981-1987 was $674 million (See Appendix B). The capital cost estimate due to monitoring of $5.1 million represents a .7% average increase in capital expenditures. In 1986, annual average capital expenditures were just over $1 billion, the highest for the 1981-1987 period. The monitoring regulations would have resulted in a 0.4% increase in capital expenditures for that year. If monitoring regulations were in effect in 1984, when capital expenditures were at their lowest, expenditures would have increased by almost 2% (See Table 8.)

The impact of the $3.3 million in incremental operating costs due to monitoring would have reduced the average after-tax earnings for 1981-1987 by 1.3%. Using 1981 as being representative of the high point in the business cycle, monitoring costs would have accounted for .7% of after-tax earnings. Isolating 1982 as a worst case scenario, the average after tax losses of the firms would have increased by 8% due to the cost of monitoring.

The monitoring regulations may have a positive impact on employment. The additional 27,000 person hours which the industry reported to be required to conduct monitoring activities, together with the $5.1 million in capital expenditures they intend to make may result in added employment opportunities.

The monitoring costs are not expected to adversely affect the international competitiveness of the firms in the iron and steel sector, because monitoring accounts for a small fraction of the aggregate industry costs and profits and because the bulk of the monitoring costs will be incurred during one year.

TABLE 8

SUMMARY

IMPACT OF MONITORING COSTS
ON SELECTED FINANCIAL INDICATORS
(1981-1987)

PLANT	CAPITAL EXPENDITURES			AFTER-TAX EARNINGS		
	Monitoring Capital Cost as a % of Annual Average Capital Expenditure			Monitoring Operating Cost as a % of Annual Average after-tax earnings (Loss)		
	Highest Year	Lowest Year	Average	Highest Year	Lowest Year	Average
ALGOMA STEEL CORP.	.5	5.5	1	.4	(22)	(3.3)
RIO ALGOM (ATLAS SPECIALTY STEELS)	.05	.08	.07	.2	1.1	.3
DOFASCO	.4	3.5	.7	.5	1.6	.7
IVACO INC. (IVACO Rolling Mills)	.00	.01	.01	.06	(.3)	.1
CO-STEEL INC. (LASCO)	.5	3.8	1.0	.4	(.4)	3.0
STELCO INC.	.5	4.6	1.0	2.2	(3.2)	4.0
TOTAL	.4	1.9	.7	.7	(8.0)	1.3

Source: Company Annual Reports
Text - Section: 2

3.4 Impacts on Individual Iron and Steel Sector Firms

Dofasco

Dofasco's takeover of Algoma Steel corporation in the summer of 1988, makes Dofasco Canada's largest integrated steel producer with a capacity of approximately 6 million tonnes of steel.

The following analysis does not reflect this acquisition which added $560 million of debt to Dofasco, nor Dofasco's recent offering of 4.5 million shares of stock.

Currently, Dofasco is concentrating on improving product quality and reducing production costs. To that end, major capital investment programs are underway in primary steelmaking, hot rolling, cold rolling and galvanizing. (Dofasco Inc. Annual Report 1988). Capital expenditures for 1986 and 1987 averaged $430 million per year, up dramatically from the seven year low of $46.1 million in 1983.

The impact of monitoring costs on selected financial indicators is shown in Table 7. The estimated capital costs of monitoring represents .7% of the average annual capital expenditure during 1981-1987. If monitoring regulations were in effect during a downturn in the business cycle represented by the year 1983, annual capital expenditures would have increased by 3.5%. In an upturn, represented by 1986, monitoring costs would have represented .4% of annual capital expenditures.

Annual after-tax earnings averaged $128 million during 1981-1987. Operating costs associated with monitoring are small in relation to after-tax earnings; average annual earnings would have been reduced by .7% during 1981-1987 and by .5% in 1984 when earnings were at their highest. Even in 1982, when profits were at their lowest, the point estimate of monitoring costs represents 1.6% of after-tax earnings.

Annual operating costs per tonne of production over the period 1981-1987 averaged $404. Operating costs of monitoring would have increased this by about $.21 (See Table 9 and Appendix C).

Financial ratio analyses shown in Appendix D indicate that Dofasco is generally doing better than the industry as a whole and its competitors. Both working capital and quick ratios are larger than the industry average for the period 1981-1987 indicating the availability of liquid assets to cover monitoring expenses. Furthermore, the debt/equity and interest coverage ratios over the period are very strong and significantly better than the industry average.

From the above discussion, it appears that the monitoring costs are manageable.

Stelco

Stelco did not fare as well as Dofasco during the recession. Stelco recorded losses during the period 1982-1984 and began posting profits again in 1985.

The interest coverage ratio is beginning to improve climbing to 2.05 from -0.03 in 1983. On average, the interest coverage ratio is lower than Dofasco's but it is still greater than the industry average (See Appendix D).

Ratio analyses indicate that the working capital, quick and debt/equity ratios are both better than the industry average and comparable with Dofasco's ratios.

Recently, a capital spending program has been instituted to achieve product quality improvements and production cost reductions at Hilton Works in Hamilton. These major construction projects accounted for $270 million of capital expenditures in 1987. Further projects include a $68 million vacuum degassing facility at Lake Erie Works (Stelco Inc. Annual Report, 1988).

The impact of monitoring costs on annual average capital expenditures for the period 1981-1987, would have been 1.0%. In 1986 and 1984 when capital expenditures were at their highest and lowest respectively, monitoring costs would have increased expenditures by .5% and 4.6% respectively (See Table 8).

For the period 1981-1987, annual after-tax earnings averaged $32 million. Monitoring operating costs of $1.3 million represent 4% of annual average after-tax earnings. In 1982, the year in which after-tax earnings were at their lowest, Stelco incurred losses of $41 million. If monitoring

TABLE 9
MONITORING OPERATING COSTS
PER TONNE OF PRODUCTION
(1981-1987)

PLANT	AVERAGE MONITORING OPERATING COSTS ($ PER TONNE)	AVERAGE OPERATING COSTS ($ PER TONNE)
Algoma Steel Corp.	0.29	455
Dofasco Inc.	0.21	404
Stelco Inc.	0.27	472

Source: Operating costs and tonnage figures from the Financial Post Information Service, 1988. Production refers to ingot production for Dafasco and Stelco, and raw steel production for Algoma.

regulations were in force during this year, losses would have increased by an additional 3.2%. This compares with a reduction of 2.2% in 1981 that would have occurred when after-tax earnings were at their highest.

Annual operating costs per tonne of production over the period 1981-1987 averaged $472. Operating costs of monitoring would have increased this by about $.27 (Table 9 and Appendix C).

From the above discussion, it is evident that Stelco's financial position has improved since the recession years. After tax earnings and capital expenditures are beginning to return to pre-recession periods and the ratio analyses indicate that Stelco is a significant player in the industry.

The monitoring costs do not appear to be impose significant adverse effects on Stelco Inc.

Algoma Steel Corporation

Algoma was the hardest hit of the 3 integrated steel producers during the recession. Algoma lost a total of $350.5 million during the five consecutive years leading up to 1987 during which it posted a $40.3 million profit.

Ratio analyses indicates that for most of the indicators, Algoma's performance was near or below the industry average. Of most concern is the debt/equity and interest coverage ratio. Both were far below the industry average, with the debt/equity ratio steadily rising from a low of .3 in 1981 to .97 in 1984 (See Appendix D).

To combat this weak financial position, Algoma announced a "Program of Action" in 1986. The program entailed capital expenditures to upgrade and modernize equipment to increase production, quality of products and reduce costs (Algoma Steel Corporation, Annual Report 1988).

Also, a favourable anti-dumping ruling was obtained in December 1987 against imports of Spanish structural products. This should allow Algoma to compete on a more equal footing domestically.

Algoma's products include heavy structurals, seamless tubulars and rails. The outlook for these products depends on capital goods industries which is expected to be somewhat sluggish. The company

has recently announced the shut down of two mills because of a decline in demand for drill pipe caused by low oil prices.

However, the takeover by Dofasco may strengthen the company's overall financial position.

The impact of the monitoring costs would have increased annual average capital expenditures by 1% during 1981-1987, by .5% in 1981 when these expenditures were at their highest and by 5.5% in 1984, the lowest year in the period for capital expenditures (See Table 8).

As noted earlier, Algoma has faced considerable financial difficulty, with losses averaging $70 million over the period 1981-1986. Monitoring costs would have had the greatest impact in 1985, when losses were at their lowest $3.3 million, monitoring costs would have increased losses by 22%. Looking at the effect of monitoring costs in 1981, the year in which Algoma showed the highest after-tax earnings, earnings would have been reduced by 0.4% due to monitoring.

Annual operating costs per tonne of production over the period 1981-1987 averaged $455. Operating costs of monitoring would have increased this by about $.29 per tonne of production (See Table 9 and Appendix C).

The preceding analyses indicates that the extra costs due to monitoring are manageable for Algoma.

Lake Ontario Steel Company Division (LASCO)

Lake Ontario Steel Company is a division of Co-Steel Inc. Co-Steel Inc. manufactures and markets steel products through its operations at LASCO, Whitby, Raritan River Steel Company, New Jersey and Sheerners Steel Company, England.

In the early 1980's, Co-Steel Inc. was facing bankruptcy, with consecutive losses for 3 years totalling $63 million. By 1984, the company posted a profit of $100,000 and profits have continued to increase steadily, reaching $38 million in 1986. The strengthening of Co-Steel's financial position can be attributed to its debt reduction program, an initial share offering in 1986 and the development of new product lines.

The financial ratios as shown in Appendix D, affirm the strengthening financial position of Co-Steel.

The debt/equity ratio has steadily decreased from a high of 3.85 in 1985 to .87 in 1987. The interest-coverage ratio is also slowly improving. Lastly, the quick and working capital ratios are consistent with the larger integrated producers.

If monitoring regulations had been in effect during the period 1981-1987, average annual after-tax earnings would have been reduced by 3%. In 1986, when profits were at their highest, monitoring costs would have reduced after-tax earnings by .4%. The Monitoring Regulation would have had the greatest impact in 1984, when after-tax earnings were only $100,000 operating costs associated with monitoring would have decreased earnings by 134%.

The estimated capital costs of monitoring would have represented 1% of average annual capital expenditure for the period 1981-1987, and .5% for the year 1981, when capital expenditures were at their highest. In 1987, when capital expenditures were their lowest in the period, capital costs associated with monitoring would have accounted for 3.8% of capital expenditures.

Given the above analyses it appears that the monitoring costs are fiscally manageable.

IVACO and Atlas

Although these incremental monitoring costs appear to be small compared with the consolidated earnings of the parent companies like IVACO Inc. and Rio Algoma Ltd. (Atlas Specialty Steels Division), these costs may have a significant effect on the plant to which these costs apply.

Consolidated annual average after-tax earnings would be reduced by an average of .3% for Rio Algom (Atlas Specialty Steels Division) and .1% for IVACO Inc. (IVACO Rolling Mills) during the period 1981-1987.

For the years in which after-tax earnings were at their highest, earnings would have been reduced by only .06% and .2% for IVACO Inc. and Rio Algom respectively. Even in the worst years, after-tax earnings would have been reduced by 1% for Rio Algoma and .3% for IVACO Inc. (See Table 8).

Annual capital expenditures would also be increased by less than 1% for both companies for years in which expenditures were at their highest and lowest.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

Operating costs for the 12-month period are estimated at $3.3 million, using average laboratory prices for analytical testing. Most of this expense is for analytical services which account for 63% of operating cost estimates.

Estimated capital costs of monitoring ranged from $3.0 to $7.1 million. The range cited is due to uncertainties and contingencies associated with the capital cost estimates.

Capital costs for flow measurement was the largest expenditure amounting to 65% of total capital costs.

Total incremental monitoring costs for the iron and steel sector range from $6.3 to $10.4 million. Point estimates for individual firms are varied and range from $.03 to $2.8 million. Two companies which own four integrated steel mills will bear 92% of the total costs.

Based on comparisons of the estimated monitoring costs of the proposed Regulation with potential costs of an "equitable" set of requirements, the proposed regulations which are plant and process specific appear to be cost-effective.

Routine analyses of the current proposed process-specific regulations could save as much as $2.8 million or 62% over the "equitable" scenario.

The economic impacts of the estimated monitoring costs on the iron and steel sector are small in relation to aggregate sectoral financial indicators. If additional costs cannot be passed on as higher prices, average annual after-tax earnings for the sector would have been reduced by 1.3%.

For the individual iron and steel firms subject to MISA monitoring requirements, impacts are varied, but all appear to be fiscally manageable. Operating costs of monitoring would have generally reduced annual average after-tax profits by .1% to 3.0% per company.

The iron and steel industry is beginning to recover from the recession in the early 1980's. The iron and steel industry is very cyclical and highly dependent on domestic and international economic conditions. Although the outlook appears more buoyant, international competition will remain strong.

It does not appear that the monitoring costs will affect the competitiveness of this industry in Ontario to any significant degree.

The monitoring requirements may also produce benefits to the firm. Firms may gain goodwill, and may be seen by the public as having an environmental conscience. This is particularly valuable in today's society which is becoming increasingly concerned with environmental problems. Internationally, firms may be seen as good corporate players and will exert pressure for other companies to become environmentally aware. Companies may also make gains in productivity by improving processes as a result of the monitoring regulations.

Also, there is a potential for plants to reduce water usage in manufacturing processes and raw material losses in wastewaters as a result of monitoring activities.

The monitoring regulations may have a positive temporary impact on employment. The plants reported that approximately 27,000 person hours would be devoted to monitoring. Moreover, most plants intend to install flow and sampling devices at a cost of between $3.0 to $7.1 million. These capital expenditures may necessitate additional labour requirements.

The monitoring requirements will result in increased demand for laboratory services and for flow measurement and sampling equipment. The monitoring database will be available to design cost-effective control programs aimed at eliminating toxic contamination where it occurs.

Lastly, the benefits of reducing pollution include enhanced recreation activities, better drinking water, better asethics and the knowledge that our society has taken a step towards preserving our water for generations to come.

4.2 Recommendations

In order to identify possible problems at an early stage, it is recommended that the MOE also monitor the actual incremental capital and operating costs of the monitoring activities during the tenure of the Regulations. Early identification of possible financial burdens will enable the MOE and the individual plant to review and assess workable solutions.

Also, at the end of the regulation period, each plant should report the actual incremental costs incurred in meeting MISA monitoring requirements in order to:

- validate and improve the cost-estimation procedures used in this report.

- monitor and assess the financial and employment impacts of the monitoring requirements.

- help to determine the full financial impact of the MISA requirements in both a domestic and international context when the costs of the limits regulations are determined.

Finally, when monitoring data and activities at these plants (and other industrial dischargers) are audited by the MOE personnel or their agents, information should be gathered to determine whether the monitoring activities or data have been, or could be, helpful in making the operations or processes production more efficient and productive.

APPENDIX A
ESTIMATED INCREMENTAL COSTS OF MONITORING
AVERAGE LABORATORY PRICES
($)

ACTIVITY	Erie	STELCO* Hilton	STELCO Total	DOFASCO* Hamilton	ATLAS Welland	ALGOMA Sault Ste.	IVACO L'Original	LASCO Whitby	TOTAL
Number of Sampling Points	5	9	14	12	8	14	4	3	55
SAMPLING									
Capital									
Equipment and Installation(1)	22,000	104,000	126,000	272,840	42,500	1,100,000	0	30,000	1,571,340
Buildings(2)	9,000	58,000	67,000	154,403	12,500	0	0	0	233,903
Operating									
Operation and Maintenance	11,250	30,000	41,250	45,000	15,000	100,000	0	4,088	205,338
Vehicle Leasing	6,000	6,000	12,000	6,000	6,000	0	0	6,000	30,000
Personnel(3)	55,000	220,000	275,000	82,520	40,800	0	2,240	32,700	433,260
Transportation - in plant	500	3,413	3,913	217	185	217	10	172	4,714
- to lab	10,296	5,148	15,444	5,148	8,580	60,060	3,115	4,290	96,637
Total Sampling	114,046	426,561	540,607	566,128	125,565	1,260,277	5,365	77,250	2,575,191
FLOW MEASUREMENT									
Capital									
Equipment and Installation	237,000	1,050,000	1,287,000	1,544,630	30,000	250,000	4,000	175,000	3,290,630
Operating									
Operation and Maintenance	12,000	51,000	63,000	81,000	0	50,000	2,240	4,088	200,328
Total Flow Measurement	249,000	1,101,000	1,350,000	1,625,630	30,000	300,000	6,240	179,088	3,490,958
ANALYTICAL TESTING (4)									
Operating Costs									
Characterization Analyses	7,747	55,377	63,124	30,688	9,063	61,078	8,673	9,408	182,034
Routine Analyses	235,261	442,171	677,432	485,007	107,777	435,182	4,518	55,863	1,765,779
Toxicity Testing	6,960	32,480	39,440	25,520	6,960	30,160	1,320	6,960	110,360
Total Analytical Testing	249,968	530,028	779,996	541,215	123,800	526,420	14,511	72,231	2,058,173
REPORTING AND ADMINISTRATION (5)									
Capital	5,000	5,000	10,000	10,000	5,000	0	0	0	25,000
Operating									
Data Entry	25,000	25,000	50,000	40,000	19,616	0	1,077	3,692	114,385
Total Reporting and Admin.	30,000	30,000	60,000	50,000	24,616	0	1,077	3,692	139,385
SUPERVISION	24,960	24,960	49,920	49,920	0	0	624	6,876	107,340
Total Operating Costs	394,974	895,549	1,290,523	851,020	213,981	736,697	23,817	134,137	3,250,175
Total Capital Costs	273,000	1,217,000	1,490,000	1,981,873	90,000	1,350,000	4,000	205,000	5,120,873
TOTAL	667,974	2,112,549	2,780,523	2,832,893	303,981	2,086,697	27,817	339,137	8,371,048
Contingencies	0	0	0	280,752	34,258	0	0	0	315,010
Analytical Testing of Intake Water(7)	89,130	155,397	244,527	165,736	68,271	0	0	0	723,061
TOTAL									
with contingencies	667,974	2,112,549	2,780,523	3,113,645	338,239	0	27,817	339,137	8,686,058
with intake water	757,104	2,267,946	3,025,050	2,998,629	372,252	2,086,697	27,817	339,137	9,094,109
both intake water and contingencies	757,104	2,267,946	3,025,050	3,279,381	406,510	2,086,697	27,817	339,137	9,409,119

Source: Industry estimates

* The estimates for equipment and installation under sampling and flow measurement include sitework, power, and plumbing. Dofasco's figures also include contingencies ranging from 10%-20%

(1) Dofasco- The estimate does not include equipment for Baywater intake- $14,920.
(2) Atlas - A Cost of 12,500 for a building has been used based on Dofasco's figures.
(3) This includes personnel for flow measurement. Both functions are performed concurrently. Stelco's estimate of personnel costs includes sampling of intake water. Stelco-Hilton costs are based on 2 two-man teams at annual salary of $55,000 per man. Stelco is proposing 2-man teams due to safety reasons.
(4) The average laboratory price from the " Inventory and Critical Review of Laboratory Resource", Dillon 1987 was used in calculating the estimates.
(5) Stelco's estimates allocated a junior programmer and a project manager to Stelco Inc. at a costs of $55,000 and a computer at $10,000. These costs have been allocated evenly between Hilton and Lake Erie Works.
(6) Stelco Hilton- Includes influent sampling equipment and installation

APPENDIX B

CAPITAL EXPENDITURES, AFTER-TAX EARNINGS BY PLANT

(1981-1987)

Annual Capital Expenditures

($'000,000)

	1981	1982	1983	1984	1985	1986	1987	Average
Dofasco	242.5	126.3	46.1	78.8	189.3	444.3	415.5	220.40
Algoma Steel Corp.	264.7	185.4	31.6	24.4	143.2	130.626	45.358	117.90
Stelco Inc.	212.3	154.107	41.782	32.4	136.3	273.51	243.8	156.31
Rio Algom Ltd.	176.2768	160.815	166	42.498	110.08	108.108	70.446	119.17
Co-Steel Inc.	40.864	5.362	7.284	14.926	19.859	16.253	24.346	18.41
Ivaco Inc.	60.809	42.576	16.596	39.53	46.32	84.406	n/a	48.37
Total	997.4498	674.56	309.362	232.554	645.059	1057.203	799.45	673.66

Source: For all companies except Dofasco, the information is consolidated on a company basis
The source is the Financial Post Information Service , 1988.
The information for Dofasco is for the Hamilton plant only and was obtained
from Dofasco.

After-Tax Earnings

($'000,000)

	1981	1982	1983	1984	1985	1986	1987	Average
Dofasco	143.1	54.7	112.9	163.8	147.7	127.3	145.2	127.81
Algoma Steel Corp.	165	-40.4	-126.7	-45.7	-3.3	-134.9	40.3	(20.81)
Stelco Inc.	82.8	-40.8	-14.2	-3.3	77.6	57.593	63.393	31.87
Rio Algom Ltd.	65.832	17.813	51.14	73.887	88.348	89.883	93.075	68.57
Co-Steel Inc.	-18.734	-30.356	-14.197	0.1	21.671	37.921	32.772	4.17
Ivaco Inc.	28.4	-9.9	0.8	33.8	35.1	44.1	33.3	23.66
Total	466.398	-48.943	9.743	222.587	367.119	221.897	408.04	235.26

Source: For all companies except Dofasco, the information is consolidated on a company basis
The source is the Financial Post Information Service , 1988.
The information for Dofasco is for the Hamilton plant only and was obtained
from Dofasco.

Appendix C: MONITORING OPERATING COSTS PER TONNE OF PRODUCTION
By Plant for the Period 1981-1987

Algoma Steel Corp.	1981	1982	1983	1984	1985	1986	1987	Average
Total Operating Expenses ($'000)	1,222,400	1,000,100	1,047,200	1,168,700	1,168,200	1,168,200	1,183,800	1,136,943
Monitoring Operating Costs ($'000)	737	737	737	737	737	737	737	737
Total Raw Steel Production ('000 net tonnes)	3,017	1,899	2,306	2,528	2,742	2,422	2,590	2,501
Operating Costs Per Tonne ($ per tonne)	405	527	454	462	426	482	457	455
Monitoring costs per tonne ($ per tonne)	0.24	0.39	0.32	0.29	0.27	0.30	0.28	0.29

Stelco Inc.	1981	1982	1983	1984	1985	1986	1987	Average
Total Operating Expenses ($'000)	2,131,000	2,128,900	2,104,900	2,380,000	2,355,200	2,363,400	2,485,600	2,278,429
Monitoring Operating Costs ($'000)	1,291	1,291	1,291	1,291	1,291	1,291	1,291	1,291
Total Ingot Production ('000 net tonnes)	4,454	4,592	4,778	5,145	4,991	4,880	4,942	4,826
Operating Costs Per Tonne ($ per tonne)	478	464	441	463	472	484	503	472
Monitoring Costs per Tonne ($ per tonne)	0.29	0.28	0.27	0.25	0.26	0.26	0.26	0.27

Dofasco Inc.	1981	1982	1983	1984	1985	1986	1987	Average
Total Operating Expences ($'000)	1,538,400	1,413,800	1,426,600	1,668,200	1,767,000	1,767,400	1,943,300	1,646,386
Monitoring Operating Costs ($'000)	850	850	850	850	850	850	850	850
Total Ingot Production ('000 net tonnes)	4,258	3,636	3,700	4,468	4,373	4,035	4,048	4,074
Operating Costs Per Tonne ($ per tonne)	361	389	386	373	404	438	480	404
Monitoring Costs Per Tonne ($ per tonne)	0.20	0.23	0.23	0.19	0.19	0.21	0.21	0.21

Source: Financial Post Information Service
The information presented is consolidated on a company basis.

APPENDIX D

TABLE 1

KEY FINANCIAL RATIO ANALYSIS OF IRON AND STEEL INDUSTRY AND SELECTED FIRMS (1981-1987)

WORKING CAPITAL RATIO

Year	Industry	Algoma Steel Inc.	Dofasco	Stelco Inc.	Rio Algom Ltd.	IVACO Inc	Co-Steel Inc
1981	2.28	2.58	2.86	2.97	2.69	1.50	N/A
1982	2.37	2.83	3.87	2.93	3.06	1.70	N/A
1983	2.11	2.64	2.2	2.88	3.34	2.42	N/A
1984	2.19	2.52	2.98	3.46	3.44	2.04	1.49
1985	2.24	2.50	3.6	2.90	3.39	2.73	1.42
1986	N/A	2.29	3.4	2.67	3.45	2.31	2.05
1987	N/A	2.25	3.5	2.10	2.85	2.08	1.90

QUICK RATIO

Year	Industry	Algoma Steel Inc.	Dofasco	Stelco Inc.	Rio Algom Ltd.	IVACO Inc.	Co-Steel Inc.
1981	.88	.93	1.16	0.99	1.95	.39	N/A
1982	.82	.71	1.51	0.88	2.45	.41	N/A
1983	.94	.88	1.18	1.06	1.88	.79	N/A
1984	.9	.88	1.26	1.30	1.56	.53	.6
1985	1.02	.88	1.97	1.25	1.51	.72	.68
1986	N/A		1.66	1.13	1.61	.68	1.19
1987	N/A	.91	1.63	.85	1.31	2.08	1.24

DEBT/EQUITY RATIO

Year	Industry	Algoma Steel Inc.	Dofasco	Stelco Inc.	Rio Algom Ltd.	IVACO Inc.	Co-Steel Inc.
1981	.56	.30	.36	.39	.31	1.10	N/A
1982	.69	.53	.39	.38	.45	1.54	N/A
1983	.71	.61	.58	.35	0.42	1.12	N/A
1984	.13	.71	.34	.38	0.42	1.13	2.85
1985	.68	.83	.30	.40	0.45	.86	3.85
1986	N/A	.75	0.28	.44	0.53	.99	1.09
1987	N/A	.97	0.32	.55	0.41	N/A	.87

INTEREST COVERAGE RATIO

Year	Industry	Algoma Steel Inc.	Dofasco	Stelco Inc.	Rio Algom Ltd.	IVACO Inc.	Co-Steel Inc.
1981	3.71	9.23	8.98	2.53	5.60	1.74	.73
1982	.4	-1.34	3.35	-0.55	5.72	0.52	.52
1983	.85	-2.24	5.74	-0.03	6.30	.82	.67
1984	N/A	0.15	8.59	1.79	4.36	1.95	.88
1985	N/A	0.72	8.16	2.65	6.44	2.04	2.1
1986	N/A	- .14	5.67	1.93	5.87	2.24	1.5
1987	N/A	1.87	6.73	2.05	4.72	2.20	1.47

Source: Annual Reports and Statistics Canada Manufacturing Industries of Canada, Cat. No. 61-207 (Annual) SIC 291 and 292.

Cooper and Lybrands, "Industry Profile: Ontario Iron and Steel Producers, 1987.

APPENDIX D

TABLE 2

DEFINITIONS EMPLOYED - FINANCIAL RATIOS

WORKING CAPITAL:

$$\frac{\text{Current Assets}}{\text{Current Liabilities}}$$

QUICK RATIO:

$$\frac{\text{Current Assets - Inventories}}{\text{Current Liabilities}}$$

DEBT/EQUITY RATIO:

$$\frac{\text{Total Debt Outstanding (Short and Long Term)}}{\text{Book Value of Shareholders' Equity}}$$

INTEREST COVERAGE RATIO:

$$\frac{\text{Net Earnings (Before Extraordinary items) plus income taxes and interest charges}}{\text{Total interest charges}}$$

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